

# PATENT COOPERATION TREATY

**PCT**

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 05 October 2000 (05.10.00)	
International application No.: PCT/GB00/00819	Applicant's or agent's file reference: A25763 WO
International filing date: 08 March 2000 (08.03.00)	Priority date: 31 March 1999 (31.03.99)
Applicant: RAI, Jagmohan, Singh et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:

30 June 2000 (30.06.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer:  J. Zahra Telephone No.: (41-22) 338.83.38
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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>A25763 WO</b>	<b>FOR FURTHER ACTION</b> <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. <b>PCT/GB 00/ 00819</b>	International filing date (day/month/year) <b>08/03/2000</b>	(Earliest) Priority Date (day/month/year) <b>31/03/1999</b>
Applicant  <b>BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

18

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00819

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 H04L29/06 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>KRELLER B ET AL: "UMTS: A MIDDLEWARE ARCHITECTURE AND MOBILE API APPROACH" IEEE PERSONAL COMMUNICATIONS,US,IEEE COMMUNICATIONS SOCIETY, vol. 5, no. 2, April 1998 (1998-04), page 32-38 XP000751833            ISSN: 1070-9916            page 32, right-hand column, line 22 -page 33, right-hand column, line 2            page 33, right-hand column, line 31 -page 34, left-hand column, line 10            page 35, left-hand column, line 24 -page 36, right-hand column, line 37</p> <p style="text-align: center;">--- -/--</p>	1-11

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

29 May 2000

Date of mailing of the international search report

07/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
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Authorized officer

Karavassilis, N

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00819

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 841 769 A (OHSAWA TOMOKI ET AL) 24 November 1998 (1998-11-24) column 4, line 37 -column 6, line 59	1,2,6-11
Y	column 13, line 64 -column 14, line 13 column 14, line 44 - line 62 ----	3-5
Y	WO 97 37500 A (BRITISH TELECOMM ;TITMUSS RICHARD JOHN (GB); WINTER CHRISTOPHER SI) 9 October 1997 (1997-10-09) page 8, line 26 -page 13, line 7 page 15, line 13 -page 20, line 1 page 33, line 8 -page 34, line 14 ----	3-5
A	US 5 812 865 A (GOLDSTEIN RICHARD J ET AL) 22 September 1998 (1998-09-22) claims 1,4 ----	8-10
A	PERKINS C E: "MOBILE-AP, AD-HOC NETWORKING, AND NOMADICITY" PROCEEDINGS OF THE ANNUAL INTERNATIONAL COMPUTER SOFTWARE AND APPLICATIONS CONFERENCE (COMPSAC),US,LOS ALAMITOS, IEEE COMP. SOC. PRESS, vol. CONF. 20, page 472-476 XP000684381 ISBN: 0-8186-7579-9 the whole document -----	2

# INTERNATIONAL SEARCH REPORT

Information on patent family members

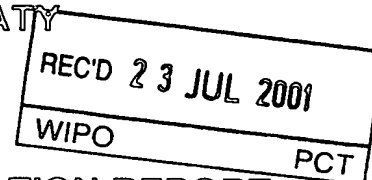
International Application No

PCT/GB 00/00819

Patent document cited in search report		Publication date	Patent family m mber(s)	Publication date
US 5841769	A	24-11-1998	JP 2636764 B	30-07-1997
			JP 8172669 A	02-07-1996
			JP 2778505 B	23-07-1998
			JP 8237717 A	13-09-1996
			JP 2720837 B	04-03-1998
			JP 8256179 A	01-10-1996
			US 5883890 A	16-03-1999
WO 9737500	A	09-10-1997	AU 2172397 A	22-10-1997
			CA 2248926 A	09-10-1997
			EP 0890270 A	13-01-1999
			NO 984506 A	27-11-1998
US 5812865	A	22-09-1998	NONE	

## PATENT COOPERATION TREATY

PCT



## INTERNATIONAL PRELIMINARY EXAMINATION REPORT



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>A25763 WO</b>		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/GB00/00819</b>	International filing date (day/month/year) <b>08/03/2000</b>	Priority date (day/month/year) <b>31/03/1999</b>	
International Patent Classification (IPC) or national classification and IPC <b>H04L29/06</b>			
Applicant <b>BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY</b>			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of sheets.

## 3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  <b>30/06/2000</b>	Date of completion of this report  <b>19.07.2001</b>
Name and mailing address of the international preliminary examining authority:  <b>European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465</b>	Authorized officer  <b>Lebas, Y</b>  Telephone No. +49 89 2399 8980 

INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

International application No. PCT/GB00/00819

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-12 as originally filed

**Claims, No.:**

1-11 as originally filed

**Drawings, sheets:**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/GB00/00819**

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**



**Cited Document:**

D1: KRELLER B ET AL: 'UMTS: A MIDDLEWARE ARCHITECTURE AND MOBILE API APPROACH' IEEE PERSONAL COMMUNICATIONS,US,IEEE COMMUNICATIONS SOCIETY, vol. 5, no. 2, April 1998 (1998-04), page 32- 38 XP000751833 ISSN: 1070-9916

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1a. In accordance with features of claim 1, D1 discloses:

a method of routing communications data to a user located in one of a plurality of data networks by a router (SAM in the Mobility Gateway, see D1, page 35, left-hand column, lines 25-44), the router having a data store provided with data relating to characteristics of the networks ("network profile" in D1, page 35, right-hand column, lines 3-5 and 8-14), the method comprising:

receiving user location information relating to the identity of the data network to which the user is currently connected (network profile is updated by the UAL, see D1, page 35, right-hand column, lines 5-6 and Table 3);

receiving communications data to be sent to the user (D1, page 35, left-hand column, lines 8-14);

retrieving from the store the associated characteristics of the data network to which the user is currently connected (see D1, page 35, right-hand column, lines 25-27);

adapting the communications data so as to be compatible with the retrieved characteristics (D1, page 35, left-hand column, lines 32-44); and

sending the adapted communications data to the user (D1, page 35, left-hand column, lines 37-44).

- 1b. The subject-matter of claim 1 differs from the disclosure of D1 in that the router retrieves not only stored information about the network characteristics, but also stored information about the associations between the networks.

However, the router (mobility gateway) of D1 has access to the SAM (System Adaptability Manager), which can make a choice between different available networks, based for example on their available bandwidth, to adapt the communication between router and user (mobile) device (see D1, page 35, left-hand column, lines 32-36).

In order to perform this adaptation of the communications, the SAM needs obviously to have access to data concerning the relations between the networks that can connect the user (mobile) device to the router.

The fact that this interconnectivity data (which relates to "associations between the networks", like formulated in the claims) is available to the router is therefore implicit from the disclosure of D1 and cannot be regarded as inventive.

Therefore, the subject-matter of claim 1 does not involve an inventive step (Articles 33(1) and 33(3) PCT).

2. Independent claim 8 is a claim for a computer program to be loaded on a computer, computer program corresponding to the method of claim 1.

The arguments set out for the subject-matter of claim 1 (see points 1a and 1b) also apply to the subject-matter of claim 8.

The fact that this program is to be loaded on a computer constitutes a minor feature, obvious for a skilled person.

Therefore, as for claim 1, the subject-matter of independent claim 8 does not involve an inventive step (Article 33(3) PCT).

3. Independent claim 10 is a claim for a computer program stored on a medium, computer program corresponding to the method of claim 1.

The arguments set out for the subject-matter of claim 1 (see points 1a and 1b above) also apply to the subject-matter of claim 10.

The fact that this program is stored on a medium constitutes a minor feature, obvious for a skilled person.

Therefore, as for claim 1, the subject-matter of independent claim 10 does not involve an inventive step (Article 33(3) PCT).

4. Independent claim 11 is a claim for a computer system (processing means) corresponding to method claim 1.

The arguments set out for the subject-matter of claim 1 (see points 1a and 1b above) also apply to the subject-matter of claim 11.

Therefore, as for claim 1, the subject-matter of independent claim 11 does not involve an inventive step (Article 33(3) PCT).

5. The additional features of dependent claims 2-7 and 9 add nothing of apparent inventive significance to claims 1 and 8, being either features rendered obvious by document D1, or features readily apparent to a skilled person based on his common general knowledge of the art (Articles 33(1) -(3) PCT).

#### **Re Item VII**

#### **Certain defects in the international application**

The fact that the Applicant is not willing to correct the following defects during the PCT phase but only during the regional phase is irrelevant to the International Preliminary Examining Authority whose task is to check that the application complies **with all** the PCT regulations. The objections of the Written Opinion are therefore reiterated:

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. The independent claims are not in the two-part form required by Rule 6.3(b) PCT.
3. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

**Re Item VIII**

**Certain observations on the international application**

1. The Application contains independent computer program claims (claims 8 and 10) of overlapping scope.

The subject-matter set out in these claims relates to embodiments having the same essentials technical features and differing only in minor details (like the storage location of the computer program). The requirements of Article 6 PCT regarding conciseness and clarity of these claims as a whole are thus not met.

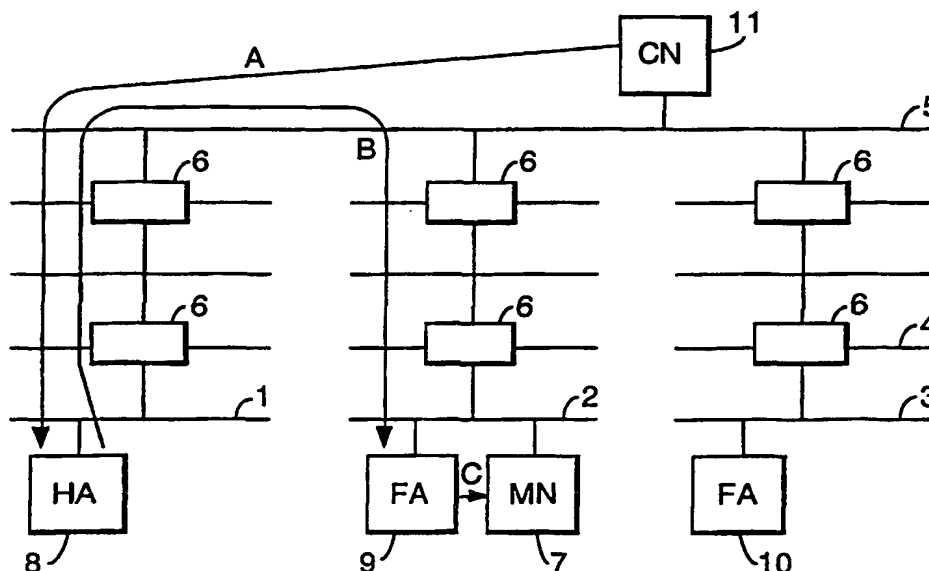
The set of claims should have been recast in order to include a single independent claim in each category followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : <b>H04L 29/06, H04Q 7/22</b>		A1	(11) International Publication Number: <b>WO 00/59178</b>
			(43) International Publication Date: 5 October 2000 (05.10.00)
(21) International Application Number: PCT/GB00/00819 (22) International Filing Date: 8 March 2000 (08.03.00) (30) Priority Data: 9907464.3      31 March 1999 (31.03.99)      GB 99305544.1      13 July 1999 (13.07.99)      EP (71) Applicant (for all designated States except US): BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): VRAI, Jagmohan, Singh [GB/GB]; 74 Allenby Road, Southall UB1 2HH (GB). ANDERSON, Mark [GB/GB]; 13 Drayton Grove, London W13 0LA (GB). WRIGHT, Shaun [GB/GB]; 1 Brotherton Avenue, Trimley St. Mary, Felixstowe, Suffolk IP11 0YL (GB). FENTON, Christopher, John [GB/GB]; 1 Belgrave Close, Ipswich, Suffolk IP4 2TT (GB). (74) Agent: LIDBETTER, Timothy, Guy, Edwin; BT Group Legal Services, Intellectual Property Dept., Holborn Centre, 8th floor, 120 Holborn, London EC1N 2TE (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  Published With international search report.	

(54) Title: METHOD OF ROUTING DATA



## (57) Abstract

A home agent (8), attached to a home network (1), receives, adapts and forwards messages intended for a mobile node (7) attached to one of a plurality foreign networks (2, 3). The home agent, having received a message, passes the message on to a processing unit (12) to assess whether the message should be adapted so as to be compatible with the destination foreign network and to adapt the message accordingly. The adapted message is returned to the home agent to be encapsulated and tunnelled to a foreign agent (9) attached to the destination foreign network. The foreign agent decapsulates the message and passes it on to the mobile node. This method has the advantage that the mobile node is able to receive messages regardless of the type of network to which it is attached.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

### METHOD OF ROUTING DATA

The present invention relates to the routing of data within communications networks, including but not confined to networks such as the Internet and particularly, but not exclusively, to a method of routing data directed to a mobile node. The mobile node may be a mobile host, such as a portable computer, or it may be a router which is responsible for the mobility of one or more entire networks, for example, the mobile data network within an aircraft. In either case, the mobile node may change its point of attachment from one network or sub-network to another.

The routing of data around the diverse networks which make up the Internet is based on a protocol known as the Internet Protocol (IP). Data is transferred in the form of data units known as IP datagrams between points in the Internet specified by IP addresses. The detailed specification of IP is available in a "Request for Comments" document, RFC 791, maintained by the Internet Engineering Task Force (IETF). RFC documents are widely available on the Internet.

The current version of IP, known as IPv4, does not itself support mobility, but a protocol entitled "IP Mobility Support", commonly referred to as Mobile IP, has been designed to enhance IPv4 to support mobility. This protocol is described in document RFC 2002, available as detailed above. The next generation of IP (IPv6) is being specifically designed to deal with the mobility requirement.

IPv4 assumes that a node's IP address uniquely identifies the node's fixed point of attachment to the Internet. If the node is transferred to a different point, it can only be contacted by allocating it a new IP address. Mobile IP, however, enables a mobile node, such as a laptop or palmtop computer, to

send and receive IP datagrams over the Internet regardless of the physical location at which it is connected to the Internet and without changing its IP address.

However, a mobile node may find itself in many different environments, attached to data networks of varying types that serve different purposes.

A mobile node may be linked to a network by a variety of different media, some suited to transmission of high volume data, some not. Some networks may themselves not be able to support higher data rates. A mobile user attached to a particular network may wish to receive data in a particular format, for example to receive web-page data in abridged form, without pictures, or an e-mail in the form of a voice message. In a particular example, a "Wireless Application Protocol" (WAP) has been specially developed for the bandwidth constraints and screen size associated with cellular telephony. If a user is currently using a network suited to that technology, it would be convenient to have the data transmitted in that form. However, if the user is connected to a higher bandwidth system, he may wish to receive the data in a less abbreviated form more appropriate to that other network.

There may also be special associations between the home and visited networks of the transmitter and sender of the data, for example functionality only available if both parties are working on (visiting) the same network, or a service level agreement made between the network operators.

According to the present invention there is provided a method of routing communications data to a user located in one of a plurality of data networks by a router, the router having a data store provided with data



relating to characteristics of the networks and the associations between the networks, the method comprising:

receiving user location information relating to the identity of the data network to which the user is currently connected;

5 receiving communications data to be sent to the user;

retrieving from the store the associated characteristics of the data network to which the user is currently connected, and the associations between that network and other networks;

10 adapting the communications data so as to be compatible with the retrieved characteristics, and

sending the adapted communications data to the user.

The router may be a home agent attached to a home network.

The communications data may comprise text data.

The adapted communications data may comprise voice data.

15 The adapting of the communications data may comprise summarising the communications data.

The adapted communications data may be received by an intermediary router and re-routed to the user.

20 The user and the intermediary router may be attached to the same one of the plurality of data networks.

According to the present invention, there is also provided a computer program to be loaded on a computer to route communications data to a user located in one of a plurality of data networks each with associated  
25 characteristics, such that the computer :

stores data relating to characteristics of the networks and the associations between the networks;

receives user location information, wherein the user location information includes the identity of one of the plurality of data networks;

5 receives communications data to be sent to the user;

adapts the communications data so as to be compatible with the associated characteristics of the data network to which the user is currently connected, and the associations between that network and other networks; and

10 sends the adapted communications data to the user.

The computer program may have been down-loaded from a server and stored in storage means prior to loading on a computer.

According to the present invention, there is further provided a computer  
15 program stored on a medium, for controlling a computer to route communications data to a user located in one of a plurality of data networks by:

receiving user location information which includes the identity of one of the plurality of data networks;

20 receiving communications data to be sent to the user;

retrieving, from a store of data relating to characteristics of the networks and the associations between the networks, the data relating to the characteristics of the said one of the plurality of data networks;

adapting the communications data so as to be compatible with the  
25 associated characteristics of said one of the plurality of data networks and sending the adapted communications data to the user.

According to the present invention, there is further provided processing means to carry out data processing on communication data, the processing means comprising:

5 first receiving means to receive network information relating to each of a plurality of data networks, wherein the network information includes data network type;

storage means to store network information;

second receiving means to receive user location information from a router, wherein the user location information includes the identity of a  
10 selected one of the plurality of data networks;

third receiving means to receive from the router communications data to be sent to the user;

information retrieval means to retrieve network information relating to the selected data network;

15 adapting means to adapt the communications data so as to be compatible with the data network type of the one of the plurality of data networks and

output means to output the adapted communications data to the router.

20 An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1a is a schematic diagram of the general arrangement of a mobile IP based system;

Figure 1b shows the flow of data to a mobile node attached to a  
25 foreign network in the system of Figure 1a;

Figure 2 is a schematic block diagram of a system according to the present invention for use with the method according to the present invention;

Figure 3 is a schematic of a parameter table and

Figure 4 is a process flow diagram by which data in a message is adapted by the processing unit.

Referring to Figure 1a, the Internet comprises a large number of networks and sub-networks 1, 2, 3, 4, 5 connected via routers 6. A router may be a  
5 general purpose computer programmed to perform routing tasks. Increasingly, routers throughout the Internet are dedicated pieces of hardware provided by companies such as Cisco Systems, California, USA. In either case, the functionality of a router intended for use in an IP based network is defined in RFC 1812.

10 A mobile node (MN) 7, which may be a laptop or notepad computer or a mobile telephone terminal, is normally connected to the Internet via a home network 1. The unique IP address assigned to the node 7 is known as its home address. Mobility agents, known as foreign agents (FA) and home agents (HA), advertise their presence on a network via availability messages  
15 known as Agent Advertisements. A mobility agent is typically a router connected to a particular network; for example, a home agent 8 is a router connected to the home network 1 and foreign agents 9, 10 comprise routers connected to foreign networks 2, 3 respectively. The mobile node 7 may optionally solicit an Agent Advertisement message from any local  
20 mobility agents via an Agent Solicitation message. By receiving Agent Advertisements, the mobile node 7 is able to determine whether it is on its home network 1 or on a foreign network 2, 3, 4, 5.

While the mobile node 7 is on its home network, it has no need for mobility services. When the mobile node 7 is temporarily moved to a first foreign  
25 network 2, as shown by the dotted box in Figure 1a, it obtains a temporary care-of address on the foreign network 2. This can be a foreign agent care-of address, which is the IP address of the foreign agent, obtained by receiving or soliciting Agent Advertisements from any foreign agents based

on the foreign network 2. Alternatively, the care-of address may be obtained by using an external assignment mechanism, such as Dynamic Host Configuration Protocol (DHCP) (the reader is referred to RFC 1541 for further information), in which case it is known as a co-located care-of address.

The mobile node 7 then registers its new care-of address with its home agent 8 by exchanging Registration Request and Registration Reply messages with it. Registration provides a mechanism by which mobile nodes can communicate their current reachability information to their home agent. The registration process is described in more detail below, assuming that the mobile node 7 on the foreign network 2 is registering a foreign agent care-of address received via an Agent Advertisement from, for example, first foreign agent 9.

First, the mobile node 7 sends a Registration Request message to the first foreign agent 9, which processes it and forwards it to the mobile node's home agent 8. The Registration Request message includes the IP address of the foreign agent. The home agent 8 sends a Registration Reply message to the first foreign agent 9 granting (or denying) the registration request. The first foreign agent 9 processes this Reply and forwards it to the mobile node 7. This process establishes a temporary address for the mobile node 7 to which datagrams can be delivered while the node is roaming away from its home network 1.

If the mobile node 7 is returning to its home network 1 having been on a foreign network 2, 3, it re-registers with its home agent 8, through exchange of Registration Request and Registration Reply messages.

Referring to Figure 1b, when a correspondent node (CN) 11 attached to a network 5 sends a message intended for the mobile node 7, while it is

connected to the first foreign network 2, the message is intercepted by the home agent 8, as shown by arrow A. The home agent 8 encapsulates the datagrams forming the message with the care-of address for the mobile node 7, in this example being the IP address of the first foreign agent 9, and forwards the message to the first foreign agent 9. The transmission of the encapsulated datagrams, shown by arrow B, is known as tunnelling. The first foreign agent 9 receives the datagrams, decapsulates them and forwards them to the mobile node 7, as shown by arrow C. Messages from the mobile node 7 to other nodes in the Internet need not follow this route, but may be sent directly via an appropriate router, which may be the first foreign agent 9.

The concepts of encapsulation and tunnelling are described in detail in RFC 2003, "IP Encapsulation within IP". The model is that a tunnel is the path followed by a datagram while encapsulated. Encapsulation allows an IP datagram to be hidden from intermediate routers which would incorrectly attempt to route it to the mobile node. Instead, the datagram is routed between the encapsulator and a knowledgeable decapsulator, such as a foreign agent, which can correctly route the datagram. The home agent 8 and first foreign agent 9 are known as the endpoints of the tunnel. In the case of the co-located care-of address, the mobile node itself acts as an endpoint of the tunnel.

Examples of various tunnelling schemes which enable efficient routing of data to a mobile node to be maintained when the mobile node moves between its home network and foreign networks are given in US-A-5 325 362 (Aziz) and Johnson D B: "Ubiquitous Mobile Host Internetworking", Proceedings of the workshop on workstation operating systems, 14 October 1993, pp. 85 - 90, XP000672247.

Referring to Figure 2 the home agent 8, for example a personal computer running software which provides routing functionality, is configured so that before any datagrams are tunnelled to the first foreign agent 9, a processing unit 12 can intervene.

5 In this example, the function of the processing unit 12 is implemented in software on the same general purpose computer running the software which provided the routing functionality. The software, in the form of an executable computer program, is stored on a hard disc or removable hard drive, having been down-loaded from a server or installed from installation  
10 discs. The program is loaded from storage into computer memory and executed.

The processing unit 12 comprises a user interface 13, as well as processing capability to execute user applications 14. It is also provided with data storage in the form of a user details database 15. The user details database  
15 15 contains a list of foreign agents 9, 10, together with their IP addresses and several characteristics of the foreign networks to which they are attached. The principal function of the processing unit 12 is determine whether data contained in a message destined for a particular foreign network requires adapting depending on the characteristics of the  
20 destination network and to carry out any necessary adaptation.

Before the system can operate, a list of foreign agents 9,10 and the characteristics of the foreign networks 2, 3 to which each foreign agent is attached is entered into the user details database 15. In this example, the first and second foreign networks 2, 3 are a telecommunications and an  
25 office network respectively. Network characteristics are entered either manually, through the user interface 13, and/or automatically updated from a foreign network server. This list of foreign agents 9,10 together with the

network characteristics associated with them are updated, whenever a foreign network is added, modified or removed.

Referring to Figure 3, a parameter table 16 held in the database comprises: IP addresses 17 of foreign agents, network quality parameters 18, user-defined parameters 19 and characteristics 20 of the connection between a foreign agent 9, 10 and mobile node 7. For example, network quality parameters 18 include data transfer rates to foreign agents 18a, access delays 18b and bit error rates 18c. User-defined parameters 19 include the type of data 19a expected to be received by the mobile node 7 and security risk 19b. If a foreign network 2, 3 is known to be insecure, then it is preferable not to send sensitive data.

A method of operating the system will now be described with reference to Figure 4.

The mobile node 7, in the form of a lap-top personal computer, is attached to a first foreign network 2 by a global system for mobile communications general packet radio service (GSM GPRS). This connection has low data capacity and is not suited to high volume transfer of data. The mobile node 7 registers its care-of address with the home agent 8, which in this example is the IP address of the first foreign agent 9, according to the process already described.

The user wishes to download an e-mail message from a mail server. Therefore, in this example the correspondent node 11 is the mail server. The mail server divides the e-mail message into packets and sends it to the home agent 8.



The home agent 8 receives the data packets and passes them on, together with the care-of address, to the processing unit 12. In this example, the IP address is 192.0.1.255 (Step S1).

5 The processing unit 12 waits until it has assembled the complete e-mail message from constituent data packets before proceeding further (Step S2). Once the e-mail has been assembled, the processing unit 12 searches through the parameter table, until it finds the corresponding IP address of the first foreign agent 9 and extracts network data associated with it (Step S3).

10 The processing unit 12 decides whether the e-mail message should be adapted and whether it is safe to send it. According to the data rate entry 18a, the foreign network 2 is characterised as having a low data capacity and so the e-mail message is ear-marked to be summarised. According to data type user-preference 19a, any text messages should be converted into  
15 voice data. According security rating entry 19b, it is safe to send sensitive messages to the first foreign network 2 (Step S4).

To summarise the e-mail message, the processing unit 12 calls e-mail summarisation software, for example British Telecommunications plc 's ProSum, and executes the application on the e-mail message. Having been  
20 summarised, the e-mail message is then converted into a voice message by a text-to-voice conversion program, for example "Monologue" which generates digitised speech data (Step S5). Steps S4 and S5 may be repeated to further adapt data contained in the message according to other network characteristics.

25 Once the processing unit 12 has finished adapting the e-mail into a voice message, it disassembles the voice message data into data packets and

returns them to the home agent 8, for the packets to be encapsulated and tunnelled to the foreign network 2 (Step S6).

The encapsulated packets are received by the first foreign agent 9 where they are decapsulated and transmitted over a GSM GPRS link to the mobile  
5 node 7. The mobile node 7 waits until the complete e-mail has been received and notifies the user, whereupon the user is able to play and listen to the summarised e-mail message.

It will be appreciated that many modifications can be made to the embodiment described above.

10 For example, the processing unit 12, rather than assembling an e-mail from data packets before carrying out data adaptation, data adaptation can be carried out on each packet individually.

The adaptation carried out may be conversion of data from one graphics format into another. Examples of graphics format include, GIF, JPEG and  
15 TIFF.

The processing unit 12 may be implemented using dedicated hardware, rather than using a general purpose computer.

The advantage of such a system is that a user may receive information messages, regardless of the format of the initially sent data, the intended  
20 purpose of the data and also regardless of the network to which the user is attached.

**Claims**

1. A method of routing communications data to a user located in one of a plurality of data networks by a router, the router having a data store provided with data relating to characteristics of the networks and the associations between the networks, the method comprising:
  - receiving user location information relating to the identity of the data network to which the user is currently connected;
  - receiving communications data to be sent to the user;
  - retrieving from the store the associated characteristics of the data network to which the user is currently connected, and the associations between that network and other networks;
  - adapting the communications data so as to be compatible with the retrieved characteristics, and
  - sending the adapted communications data to the user.
2. A method according to claim 1 wherein the router is a home agent attached to a home network.
3. A method according to either claim 1 or 2 wherein the communications data comprises text data
4. A method according to any preceding claim wherein the adapted communications data comprises voice data.
5. A method according to any preceding claim wherein the adaptation of the communications data comprises summarising the communications data.

6. A method according to any preceding claim wherein the adapted communications data is received by an intermediary router and re-routed to the user

5 7. A method according to claim 6 wherein the user and the intermediary router are attached to the same one of the plurality of data networks.

8. A computer program to be loaded on a computer to route communications data to a user located in one of a plurality of data  
10 networks each with associated characteristics, such that the computer :

stores data relating to characteristics of the networks and the associations between the networks;

receives user location information, wherein the user location information includes the identity of one of the plurality of data networks;

15 receives communications data to be sent to the user;

adapts the communications data so as to be compatible with the associated characteristics of the data network to which the user is currently connected, and the associations between that network and other networks; and sends the adapted communications data to the user.

20

9. A computer program according to claim 8 wherein the computer program has been down-loaded from a server and stored in storage means prior to loading on a computer.

25 10. A computer program stored on a medium, for controlling a computer to route communications data to a user located in one of a plurality of data networks by:

receiving user location information which includes the identity of one of the plurality of data networks;

30 receiving communications data to be sent to the user;

retrieving, from a store of data relating to characteristics of the networks and the associations between the networks, the data relating to the characteristics of the said one of the plurality of data networks;

adapting the communications data so as to be compatible with the  
5 associated characteristics of said one of the plurality of data networks and  
sending the adapted communications data to the user.

11. Processing means to carry out data processing on communication data, the processing means comprising:

10 first receiving means to receive network information relating to each  
of a plurality of data networks, wherein the network information includes  
data network type;

storage means to store network information;

second receiving means to receive user location information from a  
15 router, wherein the user location information includes the identity of a  
selected one of the plurality of data networks;

third receiving means to receive from the router communications data  
to be sent to the user;

information retrieval means to retrieve network information relating to  
20 the selected data network;

adapting means to adapt the communications data so as to be  
compatible with the data network type of the one of the plurality of data  
networks and

output means to output the adapted communications data to the  
25 router.

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Fig.1a.

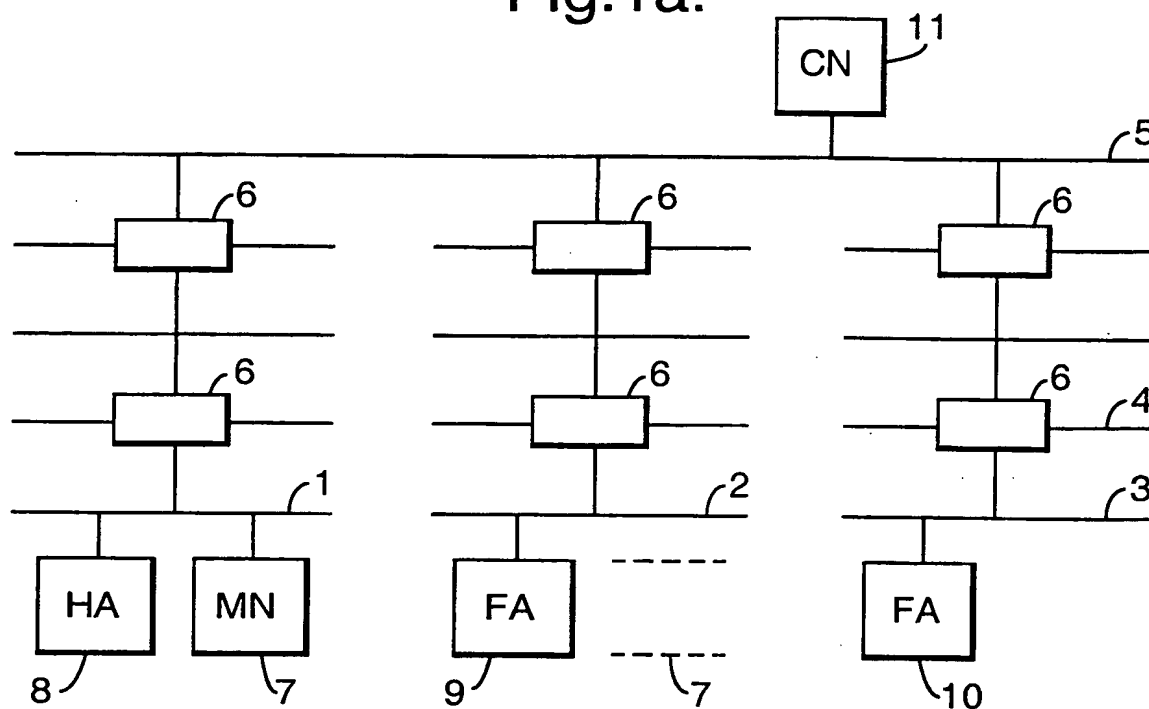


Fig.1b.

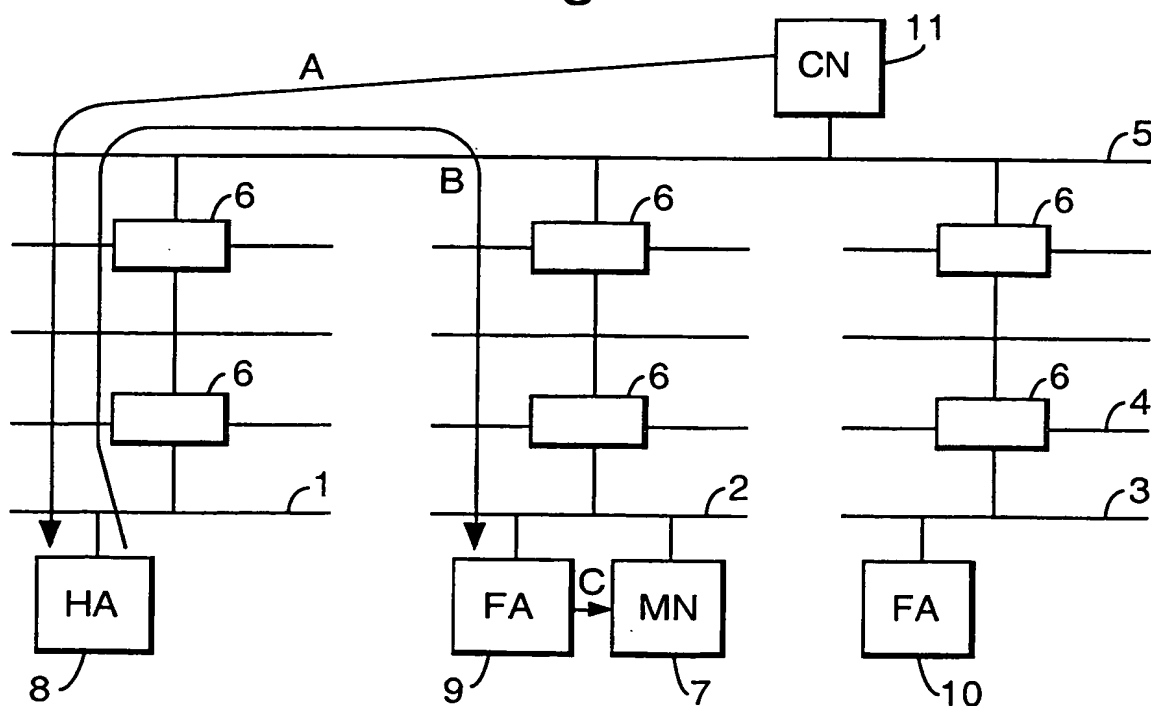


Fig.2.

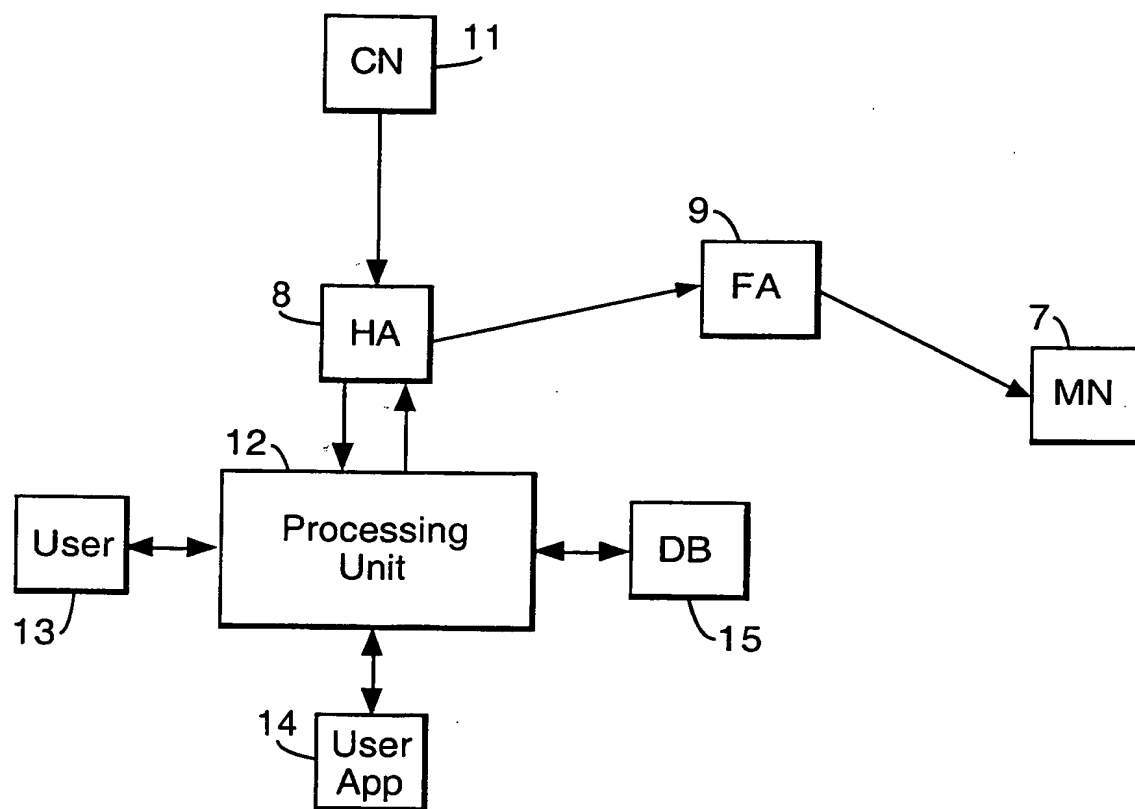


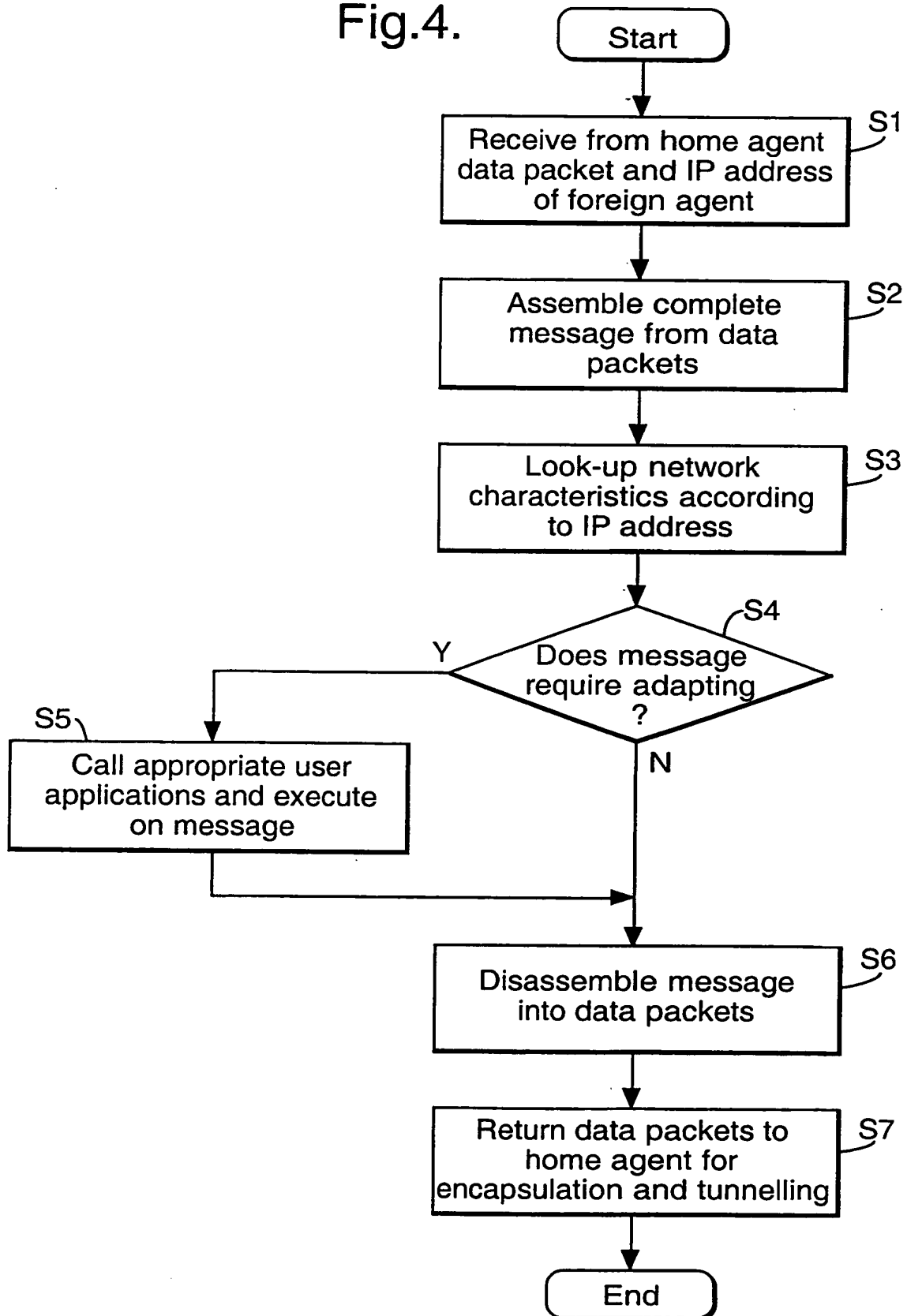
Fig.3.

16		17		18			19		20
IP Address		Quality Parameters			User-Defined		Network		
		18a	18b	18c	19a	19b			
		Data Rate (kbit/s)	Access Delay (ms)	Bit Error Rate (Max)	Date Type	Security Risk			
192.0.1.255		20	120	10e-5	Voice	Low	GSM GPRS		
192.6.2.255		9.6	120	10e-3	N/A	Low	GSM Transparent		
192.6.0.1		9.6	Variable	10e-5	Text	Low	GSM Non-Transparent		
192.6.3.8		10000	N/A	10e-9	N/A	Low	Wired LAN		
192.6.5.1		2000	50	10e-4	N/A	High	Wireless LAN		



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Fig.4.



## INTERNATIONAL SEARCH REPORT

Inter. Application No

PCT/GB 00/00819

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04L29/06 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KRELLER B ET AL: "UMTS: A MIDDLEWARE ARCHITECTURE AND MOBILE API APPROACH" IEEE PERSONAL COMMUNICATIONS, US, IEEE COMMUNICATIONS SOCIETY, vol. 5, no. 2, April 1998 (1998-04), page 32-38 XP000751833 ISSN: 1070-9916 page 32, right-hand column, line 22 -page 33, right-hand column, line 2 page 33, right-hand column, line 31 -page 34, left-hand column, line 10 page 35, left-hand column, line 24 -page 36, right-hand column, line 37  -/-	1-11

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

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"&amp;" document member of the same patent family

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# INTERNATIONAL SEARCH REPORT

Inter:      nal Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 841 769 A (OHSAWA TOMOKI ET AL) 24 November 1998 (1998-11-24) column 4, line 37 -column 6, line 59	1,2,6-11
Y	column 13, line 64 -column 14, line 13 column 14, line 44 - line 62	3-5
Y	WO 97 37500 A (BRITISH TELECOMM ;TITMUSS RICHARD JOHN (GB); WINTER CHRISTOPHER SI) 9 October 1997 (1997-10-09) page 8, line 26 -page 13, line 7 page 15, line 13 -page 20, line 1 page 33, line 8 -page 34, line 14	3-5
A	US 5 812 865 A (GOLDSTEIN RICHARD J ET AL) 22 September 1998 (1998-09-22) claims 1,4	8-10
A	PERKINS C E: "MOBILE-AP, AD-HOC NETWORKING, AND NOMADICITY" PROCEEDINGS OF THE ANNUAL INTERNATIONAL COMPUTER SOFTWARE AND APPLICATIONS CONFERENCE (COMPSAC),US,LOS ALAMITOS, IEEE COMP. SOC. PRESS, vol. CONF. 20, page 472-476 XP000684381 ISBN: 0-8186-7579-9 the whole document	2

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/00819

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5841769 A	24-11-1998	JP 2636764 B	30-07-1997
		JP 8172669 A	02-07-1996
		JP 2778505 B	23-07-1998
		JP 8237717 A	13-09-1996
		JP 2720837 B	04-03-1998
		JP 8256179 A	01-10-1996
		US 5883890 A	16-03-1999
WO 9737500 A	09-10-1997	AU 2172397 A	22-10-1997
		CA 2248926 A	09-10-1997
		EP 0890270 A	13-01-1999
		NO 984506 A	27-11-1998
US 5812865 A	22-09-1998	NONE	